Scientific Research Publishing

Modern Economy, 2026, 17(4), 561-586
https://www.scirp.org/journal/me
ISSN Online: 2152-7261
ISSN Print: 2152-7245

The Methods Suggested by Theory for a Shipowner to Become Industry's Leader

Alexandros M. Goulielmos[1,2]

[1]Department of Maritime Studies, Faculty of Maritime & Industrial Studies, University of Piraeus, Piraeus, Greece
[2]Business College of Athens, Athens, Greece
Email: am.goulielmos@hotmail.com

How to cite this paper: Goulielmos, A. M. (2026). The Methods Suggested by Theory for a Shipowner to Become Industry's Leader. *Modern Economy, 17,* 561-586.
https://doi.org/10.4236/me.2026.174030

Received: January 6, 2026
Accepted: April 13, 2026
Published: April 16, 2026

Abstract

We showed the most important features of the Greek Shipping. A brief case-study showing how a small agricultural and mountainous Nation, of less than 11m inhabitants, established, by 2025, 1440 international tramp shipping companies. Worth-noting was the fact that Greeks consistently looked after "economies of scale", and of "lower age", also in their 2nd hand purchases as well as in ordering their newbuildings. Moreover, three neglected subjects were brought up: (a) the importance of the elasticity of Supply (of a ship space); (b) the changes in the maritime distances and (c) the meaning of the "price of oil" for tanker demand. In addition, an analysis took place for 2005-2012, where shipowners, for their first time, ordered tankers and bulk carriers during a continuous falling demand... In addition, this work dealt with 3 important subjects: "Financial Engineering", "Financial Analysis" and "Income Statement Analysis". In addition, the AI, robots, and nano-satellites etc. are considered how they are going to influence shipping in future.

Keywords

Greek Shipping Features, Build or Buy Ships? How a Shipping Company Can Become More Efficient and Effective? 2005-2012: Ships Ordered in Falling Demand, Financial Engineering-Financial Analysis & Income Statement, AI and Shipping

1. Introduction

1.1. The Personal Elements in the Management of Greek-Owned Shipping Companies

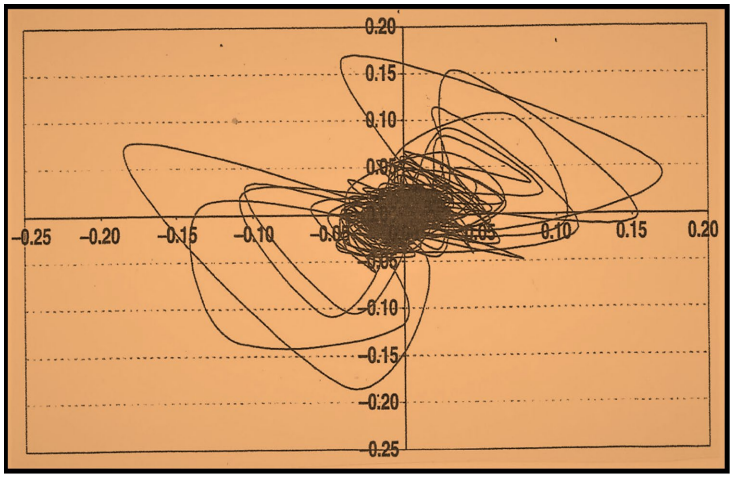
The Greek Shipping is an industry where its entrepreneurs avoid the disclosure of their business secrets to their competitors at all costs. Moreover, Greek shipowners care about their personal reputation, given that all Greek shipping companies

are personal, recognized exclusively by shipowner's surname.

My research about shipping industry has begun in UK in the framework of my doctoral thesis at Brunel University (1971-1974). It revealed eventually that shipping businesses are simple, and industry's strategies are common sense, provided one takes into account a number of realities: one of which is that the managers deal with a business world where long-term (beyond 11 months) forecasting is not possible[1].

1.2. Industry's Attractor

Another reality is that industry's attractor[2] is strange (Graph 1).



Source: author; data concerning the index of freight rates per voyage of dry cargoes, 1968-2003.

Graph 1. The shipping industry's "Strange" attractor.

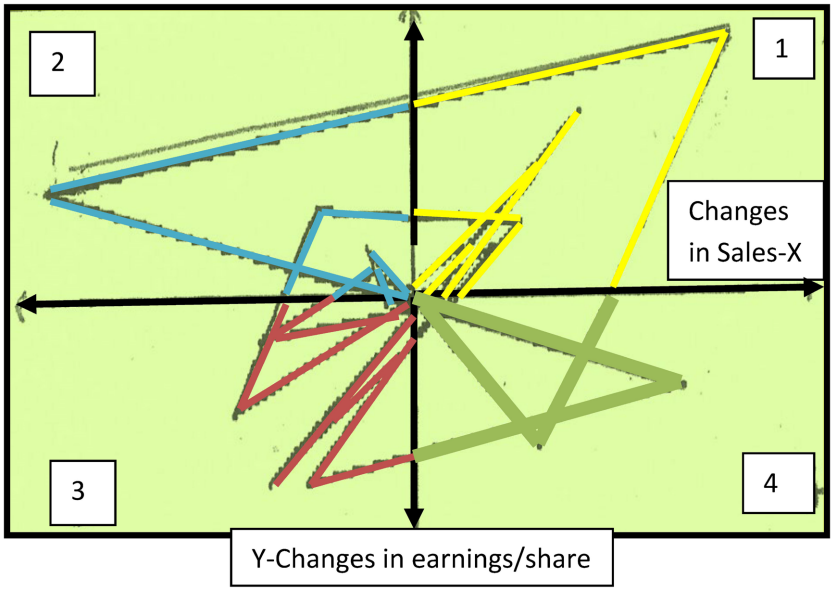
As shown, the points of the relevant time series of the freight rates concentrate in the center. The ranges in axes are up to maximum ±0.19%. It produces a "random-appearing" behavior. It shows a mathematical pattern of a measureless complexity. It weaves, folds, spirals and... confirms that disorder... is structured. This attractor is able to "control" a high-order chaos (Priesmeyer, 1992: p. 23).

[1]My doctoral student Miss Psifia M-E forecast the last 11 monthly levels of the trip freight rates index of the dry cargoes, using the nonlinear ordinary least squares method, from Oct. 2002 to August 2003, and she found: 204/203, 215/204, 215/214.5, 216/221, 216/215, 216/212, 226/208, 235/230, 230/233, 230/233, 229/228.4 (using 417 monthly observations), where the first are the actual ones. The forecasting period of about one year was determined by the maximum "Lyapunov coefficient": $(\lambda_1)^{-1} = 1/0.094 = 10.64$—11 months. Forecasting the freight rates almost a year ahead is not at all a bad effort. Near the end of the first 11 months, we may forecast the next 11 ones.

[2]An attractor is a set of points in—a phase space—towards to which the trajectories asymptotically *rend* to, in time, for a wide set of initial conditions. The points are thus "attracted" by a very strange object. The chaotic attractors, which for certain authors are also strange, have a "fractal" dimension (<1. The strange attractors are better known: for their sensitivity to initial conditions; for a no-normal frequencies distribution—not entirely random; for a form of periodicity; and for a similarity under different scales (self-similar) like the braches of a tree and the tree.

1.3. The Attractor of an Individual Company

In the enterprises, an attractor of business performance, however, may be simpler than that of the shipping industry (Graph 2).



Source: author; X = the independent variable; Y = the dependent variable; data from Priesmeyer (1992).

Graph 2. The "limit cycle" of the "Strange" attractor of the "Thiokol Corporation" (TKC-NYSE).

As shown, the "Thiokol Corporation" in about 35% of its course succeeded in increasing its $ Sales and its earnings per share (quadrant 1). In about 25% of its time, it faced a reduction in both (quadrant 3). In 20% of its time either Sales reduced (quadrant 2) or the earnings per share fell (quadrant 4). The pattern of the attractor of the "Thiokol Company" is simpler than that of the shipping industry because it is driven by many, (more systematic), processes, of *lower-order chaos, which* took place inside the firm (Priesmeyer, 1992: pp. 23-24).

Every manager is thus recommended to draw his/her company's attractor, at least from year to year, or even sooner—if there are changes in the variables. Moreover, company's "visioning" is to be used for planning company's future in the place of the impossible forecasting (Priesmeyer, 1992: pp. 177-181).

1.4. Concluding

In a business world, where the "forecaster" is the King, but he/she could never been found, the business policies, which a shipowner has to follow are those where one has *to act as the Greek shipowners did and do*. This means to act o*n the basis of a future number of decisions, which will bring-in, inevitably, rather sooner than later, certain future cost advantages...*

Those cost advantages will come mainly from the following:

A rock-bottom ship price today	*Cannot* but to rise tomorrow	A larger & younger vessel today	*Cannot* but to have a future lower per dwt cost vis-à-vis a similar smaller & older one
A rock-bottom freight rate today	*Cannot* but to rise eventually tomorrow, given demand & distances		

Source: author.

The above are three golden rules that Greek shipowners have adopted. But there is also another one perhaps more important. Timing, no doubt, is the King in Shipping. Timing is a term, or rather a prerequisite, in all shipowner's decisions, and especially when one orders ships, and buys them, and when one charters those spot, or time, and when one borrows money, and when one sells ships... In all these central decisions, there is *only one "perfect timing"*. A shipping industry's leader has to take perfectly timed decisions.

1.5. The Purpose of This Work

The main purpose of this work is to show the ways by which a shipping company can become more efficient and effective, meaning *to help shipowners to become leaders in their industry.* ***This is a conceptual essay and also a study of a rich empirical analysis. The first four parts of this work dealt with empirical issues like: the most important features of Greek Shipping from its establishment to the present, including the way they buy or build ships in*** **2025*****; the ways for a shipping company to become more efficient and effective, including the timing as to when to borrow,*** **1990-2020*****, the roles played by the elasticity of supply and distances*** **(2000-2020)*****; the impact of the level of the price of oil on the demand of tankers,*** **1861-2025*****; the remaining five parts dealt with conceptual subjects like Financial Engineering, Financial Analysis,*** **Income Statement and the effect that AI etc. may have on shipping.**

1.6. The Structure of This Work

This work is structured in 9 parts: Part I, dealt with the most important features of the Greek shipping; Part II, dealt with the question "to build or buy ships or both?" Parts III & IV dealt with the ways a Shipping Company can be managed more efficiently and effectively; Part V, dealt with what does it mean "not to be left behind" in shipping industry; Part VI, dealt with "Financial Engineering"; Part VII deal with the "nonlinear Financial Analysis"; Part VIII dealt with "Income Statement"; and Part IX, dealt with the effect that "AI" etc. may have on shipping. Finally, we concluded.

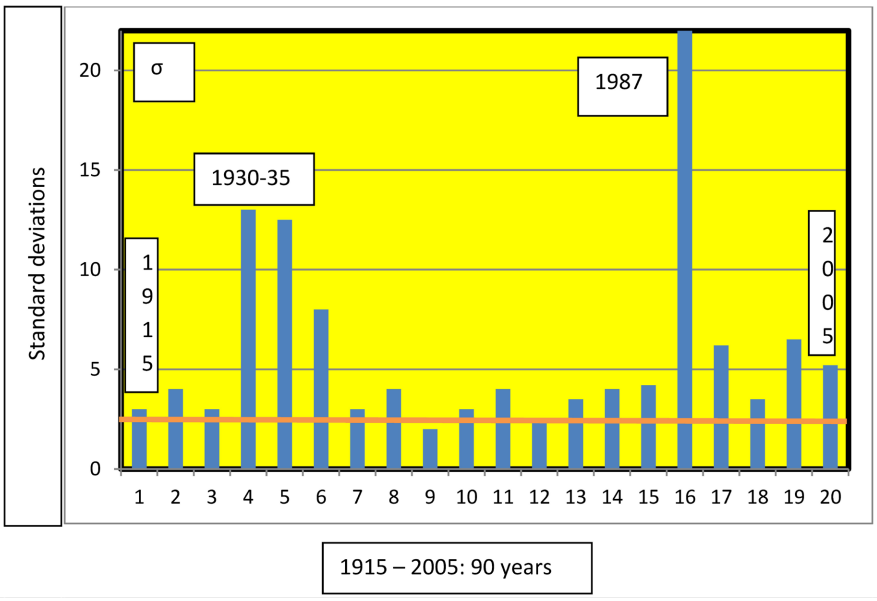
2. Literature Review

Mandelbrot and Hudson (2006) argued that the "conventional financial theory" assumed that the variation of prices can be modeled exclusively by random processes, which in effect follow a simplest pattern, which is as if each uptick, or downtick, is determined by the toss of a coin.

A more accurate model allowing, however, large price variations, paved the way for a new more reliable type of financial theory: this is the risk model known as "Extreme Value Theory" (EVT), assuming by 2006, that prices vary wildly, with fat tails, which scale, together with a long-term dependence (Mandelbrot & Hudson, 2006: p. 273).

EVT model measures the events, which occur *with very small probability*: the unexpected. It is a specialized branch of Statistics, which models the probability of rare, extreme, and catastrophic, events, occurring *in the tails of the distributions*. Tails thus have a story to tell us. Are we listening?

Mandelbrot and Hudson (2006) plotted the changes, which have occurred in the standard deviation of the "Dow Jones industrial index" between 1915 and 2005 (**Graph 3**). Two at least "extreme" events have occurred: in 1930-1935 and in 1987, in a period of 90 years.



Source: author; data from Mandelbrot & Hudson (2006: p. 93).

Graph 3. The standard deviations of the "Dow Jones Industrial Index", 1915-2005.

Graph 3 shows, indirectly, that about 68% of the standard deviations were small, i.e. within 1σ[3]; 95% were within 2σ; 98% within 3σ. Some, however, were up to 13σ, in 1930-1935—during the "great depression"—and 22σ during the

[3]σ is a letter from the Greek alphabet standing for the standard deviation, which stands also for the square root of the variance in a distribution.

"Black Monday" in 1987... As shown, the standard deviations of the "Dow Jones Industrial Index" *exceeded the 3σ benchmark 14 times*; such, large, deviations the theory of "Normal distribution" considers them improbable, and more so that one in 1987 of 22σ...

Bookstaber (2007) argued, in his book's preface in end 2008, that what we need so in order to meet the events we failed to anticipate constructively, is to pass on to simplicity—i.e. to simpler financial instruments and less leverage.

Lorange (2009) argued that a shipping company has 5 cultures so that to be successful, one of which is "Financial Engineering". With this issue we have dealt in part VI.

3. Part I: The Most Important Features of Greek Shipping

Greeks, in 2020s, managed 1440 international shipping companies, mostly run by a single person, coming from one of the thousand Aegean islands, i.e. being the father of a shipping family, or the elder brother.

Greeks followed their shipping tradition by obtaining at least 3 male children—though during the last 30 years, or so, female shipowners, daughters in a shipowning family, surprised the industry, and their fathers, with their achievements, like the manager of "Navios" shipping company, Mrs. Angelliki Frangos.

Greeks, historically, and since old times, they have expanded the *sea trade* and *shipping*, as worldwide cross-traders, as their poor agricultural mountainous country could not help them to survive. Shipowning/shipmanagement attracted Greeks from the beginning as being suitable to be managed by a single person and a quite number of Captains, in a "way of living", and not as a "profession".

A Greek shipowner is the person who mobilizes the majority of company's $ equity and gets also an "adequate" bank $ loan. To have the Money required, however, is a necessary, but not a sufficient, condition, in shipping, and the relevant knowhow is a desirable, but not a "sine qua non" condition, as it can be hired in an organizing known as "*management by departmental managers*". Thus ship owning/ship management found a fertile land in this country.

Shipowners-managers, the Greek-style, run a company, where the majority of them are not listed (Goulielmos, 2021a), and where management and ownership *coincide* in the same person. A shipping company—the Greek style—has all the characteristics, which *a Greek personality is seeking after*: i.e. "to work the hours a manager likes"; "he/she to take all final decisions"; "to employ the key-persons who he/she only thinks suitable"; "his/her opinion to have finally to be followed, often leading to split ups; his/her wife or son or daughter to take over after his premature death.

Shipowning is the ultimate most prestigious aspect of shipping businesses for a long time (Lorange, 2009), and this is one reason for attracting the Greek managers. And this will be also the reason for Greeks to emerge as shipowners/shipmanagers in years to come, if one adds the fact that shipping provides also the opportunity to make great fortunes...

Greek Companies focused on 2 types of ships: "crude oil tankers" and "dry cargo bulk carriers" for the time being. During recent times we remarked a tendency for the Greeks to order Containerships and Gas carriers as well.

Management by departments

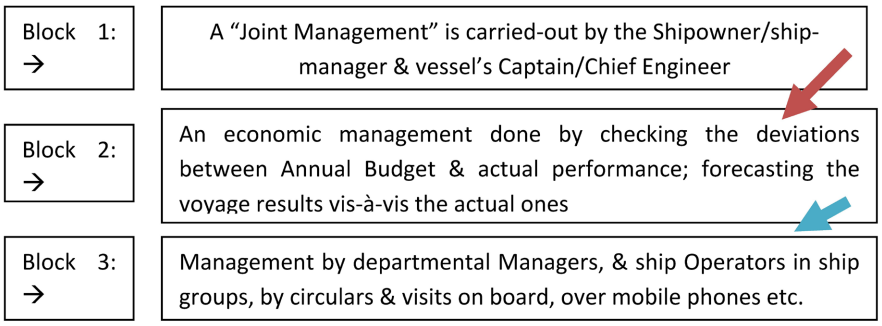
The Greek-owned shipping companies are organized—the larger ones—in a number of in-house departments, say about 15 - 18, where people are gathered together in the same function. Those have studied it by education, and they are preferred by the company, if they have learned it also in practice by sea experience, all speaking the same technical language.

We will describe very briefly only 3 departments, perhaps the most important, if one adds to them and the "Operations department". The Chartering department is responsible to make the sales of company's sea transport services, in as profitable as possible freight rates, the whole endeavor governed, however, by Supply and Demand; this department maintains also company's public relations with company's charterers/customers.

The Technical department is the one to attend the building of company's new ships and, by planned-repairs and drydockings, to have them able to do their job: to load and unload cargo, and transport it safely, from port to port. In addition an in-house crewing department is there to staff the ships with efficient and effective seamen; *this being one of the crucial functions of a shipping company, nowadays, where of course the figurehead is Captain followed by Chief Engineer.*

Shipowners do their "management by distance" through their Captains/Engineers... Thus, in shipping we have a "joint management". The controls and the orders are drafted-out and sent by the departmental managers, on the basis of their previous sea experience, circulating circulars with suggestions to ship's personnel. The departmental managers are managed by the Shipowner.

Summarizing this part, a shipping company (consisting of tramps[4]) is managed—the Greek style—by "three management blocks" (Graph 4):



Source: author.

Graph 4. The 3 blocks having management's power to control a shipping company and its vessels the Greek style.

[4]These are the ships of which their exact voyage is decided by the charterer and not by the owner.

4. Part II: To Build Ships or Not?

One can see the "optimism" of this industry by looking at the new buildings ordered by shipowners. Table 1 shows the activities of 3 top world shipping nations (Greece, China & Singapore) concerning their orders for new buildings in 2025, and the purchases and sales of 2nd hand ships carried-out by the Greek and Japanese shipowners.

Table 1. The activities of 3 top shipping nations towards new buildings, and those of Greece and Japan in S + P markets in 2025.

Greek orders → 140 ships: containerships 64: (~46%); tankers 47 (~34%); gas carriers 12 (~9%); bulk carriers 9 (~6%) (~95%); others 8 (~5%) = 100%	Chinese orders: 163; Singapore orders: 150	Greek purchases of 2nd hand ships: 179; of which bulk carriers 109 (~61%); & tankers 47 (~26%); others ~13%.
Greek sales: 272; bulkers 143 (~53%), containerships 37 (~14%), gas carriers 4 (~1.5%) (68.5%); others 31.5% = 100%	Japan sales: 156	Source: author; data from "Naftika Chronica"

As shown, Greeks sold 272 ships, while they purchased only 179 (66%), supporting our theory that Greeks achieve *economies of scale,* and of age, also in all their 2nd hand purchases. These 272 ships sold, we believe, were smaller and older than the 179 acquired... Greeks turned into ordering, heavily, containerships due to the effort of most worldwide economies to grow after the global economic crisis in 2009, and thereafter, the Pandemic in 2019-21 and thereafter. We will turn now to our core subject.

5. Part III: The Ways a Shipping Company Can Be Managed More Efficiently & Effectively

Table 2. The nowadays strategic issues that have to be solved by Shipping Management, 1973-2025.

What should be the level of equity of a shipping company?	Up to what amounts a shipping company should **borrow & at what interest rate & spread**?	Should a shipping company decide (perfectly) to build or buy ships & of what type, size & age?	How to charter ships: **time** or **spot**? Or both? Why?
• What company's depreciation should be? • How much of Gross profits should be paid to Shareholders?	What company's retained earnings have to be?	When to have ships **laid-up**? When to **scrap** ships?	When to **sell** ships (in a perfect timing); & what their size & type & age has to be?

Source: author.

Shipping Management started as a Science in 1973 (Lorange & Norman, 1973), we believe, when it has been found out, since then, that there is a number of shipping strategic issues, which had to be solved. Table 2 presents the questions, which a shipping management is called to answer, even nowadays.

The banking sector mainly, and to a much lesser degree the Stock exchanges, obliged shipping companies to adopt certain management innovations so that to be financed by them. One demand of the financiers was the need to appoint an "external auditor" in the production of company's audited figures.

Table 3 now indicates the *first* 5 *principles for a more effective and efficient shipping management.*

Table 3. The 5 management principles suggested to be applied by the more efficient & effective Shipowners.

Obtaining ships: at a reasonable price; buy & build ships **larger than hitherto,** at a rock-bottom price; buy low-priced 2nd hand ships **younger** than hitherto; sell high smaller & older ships	Financing ships: at an acceptable cost, or apply "financial engineering"; apply **perfect timing** in borrowing, whenever this is possible, as the lending interest is variable
Charter-ships-out: at a favorable rate; or time charter them high, when spot is low, and vice versa	**Lay-ships-up:** when freight rates are below operating cost for some time to avoid exceptional losses; consider scrapping obsolete ships when scrap price is high

Source: author; certain data from Lorange (2009).

The economic factors behind the above areas are, however, and familiar, and should be known to those studied economics: "*maximizing company's net profit*" or "*minimizing company's total cost*" or "*both*"...

But *what is not mentioned at all by microeconomic theory is the "Perfect Timing",* as *economics work in a timeless world...* Shipping management, however, has its own dynamic characteristics, depending on supply and demand, performing within a calendar time...

The 5th box of Table 2 reminded us that the depreciation of ships is a cost[5], which has to be subtracted from gross profits... Depreciation is determined by the level of the prices at which the manager bought, or built, company's ships, and by their (remaining and useful) life. *Depreciation is also, however, company's saving... The above mean that here also a strategy is required.*

[5]Depreciation as being a cost has to be minimized; but as being a saving has to be maximized... It depends on the level of company's gross profits. It is better to determine its % after the company decided how much profit to retain. The decision of how much profit to pay to shareholders (dividends) has its priority, *but the prior decision of all* is to repay company's long term debt. Thus the order of payments can be as follows (recommended): Attain first an as high Gross Profit as POSSIBLE given demand and supply → Repay part of company's total long term debt → decide how much of the profit to retain (*) → decide depreciation → AND THEN decide the level of dividends. (*) Have a plan for what and how many ships you should buy or build in future and save 40% at least of their expected rock bottom price.

"Accumulated depreciation" & "retained earnings" are purposed to enable a company to achieve future investment in "earning" assets (and for a potential higher future income). Shareholders, we believe, will accept a reasonable reward for their equity, if this is their only better alternative (opportunity cost).

Shareholders increase their personal income (dividends) when depreciation is low, or zero, and when the retained earnings are also low or zero, and when gross profit is high... This policy, however, means that the company decided not to grow above its initial size, and moreover the value of company's assets will fall by wear and tear and age.

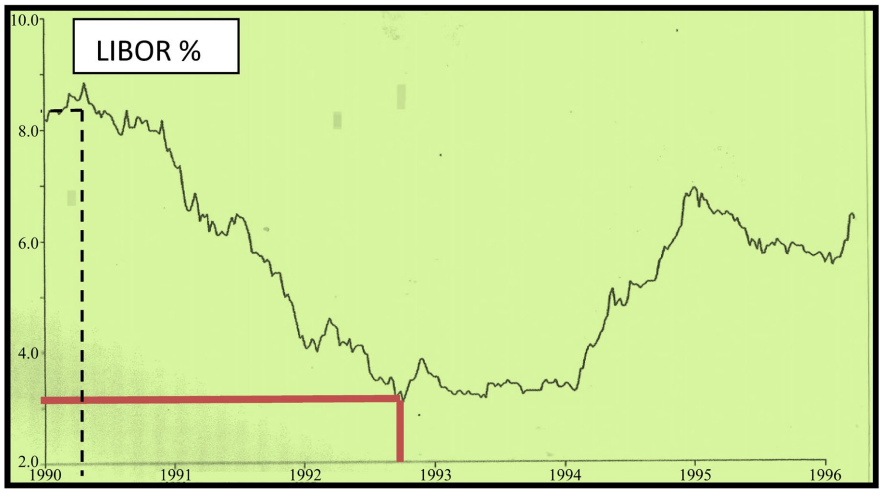
Zero depreciation, and *zero* retained earnings, however, means also to have to ask shareholders for additional equity so that the company to grow with additional ships/assets. Perhaps the company has then to borrow, so that to buy and build "earning" ships, but by *increasing its finance risk. Here also a strategy is required.*

Our experience with this industry has taught us that in times of a depression, neither banks or stock exchanges or shareholders or else, will be willing to provide cash to a company in distress. Thus the clever shipowner has to be prepared for a depression resting exclusively on his/her ability.

This means that if a 7 *years cycle is about to happen, then the first* 3 *good years to be followed by an intensive policy of higher depreciation, higher retained earnings and low dividends, and the last* 4 *years to apply a low depreciation, low retained earnings and low dividends... This company preserved this way its liquidity.*

The Perfect Timing to Borrow Money

As shown, the 2nd box of Table 2 reminded us that there is a perfect timing not only in buying and building ships, but also in borrowing money, because the basis of the lending interest rate, the LIBOR, varies over time (Figure 1 & Figure 2).

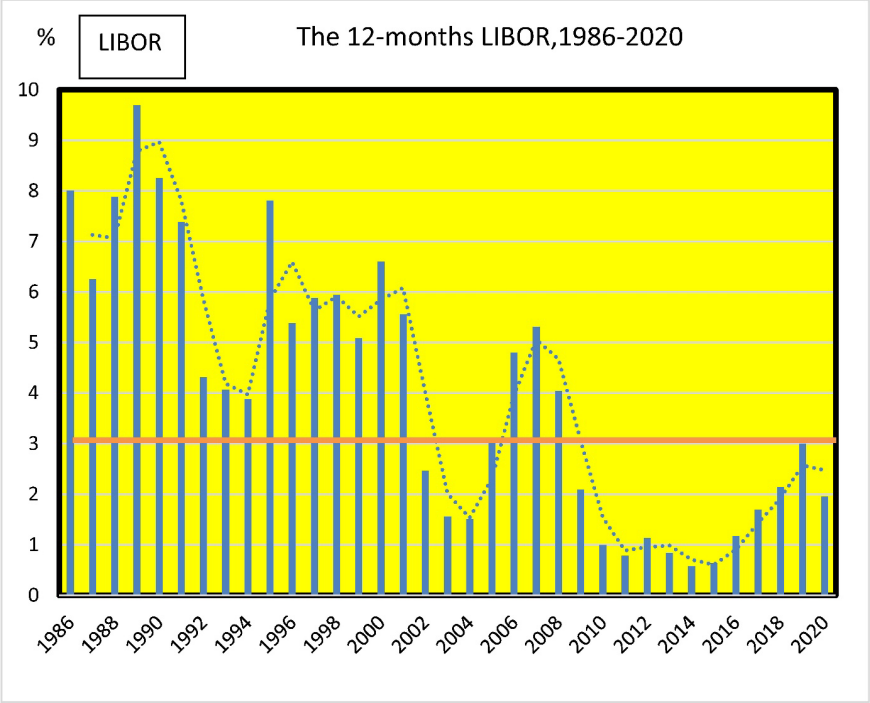


Source: author's archives.

Figure 1. LIBOR—London interbank borrowing rate—the basis of shipping loans, 1990-1997.

As shown, a non-clever shipowner will borrow money at 9%, i.e. at the lending interest rate basis in 1990, and a perfect-timer/clever one, will borrow at 3% in 1992... two years after. Given the amounts involved in building a ship, say 80% of up to an amount of $200m for a Gas carrier, is *worthwhile to finance her as "cheap" as possible*.

Figure 2 shows the performance of LIBOR after 1986.



Source: data from MacroTrends, January of each year.

Figure 2. The 12-months LIBOR, 1986-2020.

As shown, the 12-months interest rate basis-LIBOR, varied from a high 9.7% in 1989 to a low of 0.6% in 2014... The perfect timed year to borrow was apparently from 2009 to 2020 (at ≤ 3%). The "global financial crisis" in 2009-18 and the "Pandemic in 2019-21", apparently, had a beneficial impact on LIBOR by providing very cheap money to shipping entrepreneurs. The cheap money continued to be available also in 2021 at 0.32%, & in 2022 at 0.75%. The cost of money rose, however, in 2023 to 5.4% and in 2024 to 5.3% (estimated) and in 2025 at 5.2% (assumed). Concluding the part, we are sure that money to build and buy ships is cheap...

6. Part IV: 8 Further Principles If a Shipowner Wishes to Become a Leader in His/Her Industry by Managing His/Her Company More Efficiently and Effectively

The new principles are presented in Table 4. Some of them may overlap with, or contained-in, the preceding 5 principles of Table 3.

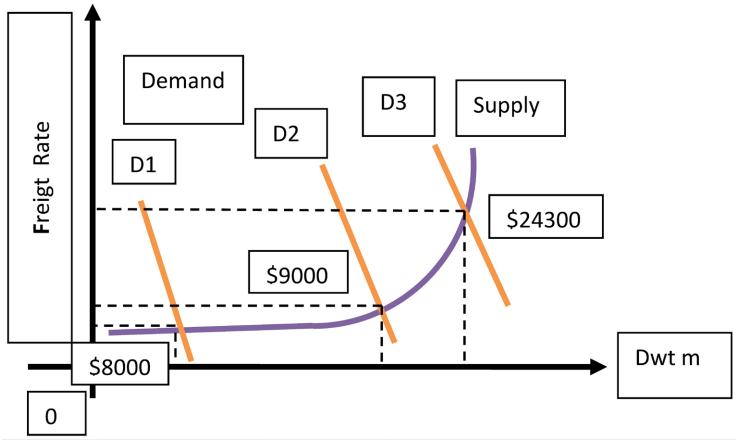
Table 4. 8 further principles to be adopted by the shipowners.

Understand the critical movements of the essential underlying 4 factors: i.e. **the demand & supply, the distances, the seaborne trade, & the freight rates**	Timing: **anticipate** the turning points of the freight rates (which is a difficult job)	Have a long view of the shipping cycle & for its ups & downs & turning points (Goulielmos, 2026); (which is a less difficult endeavor than the previous one)	**Forecast** the future markets, the interest rates, the price of oil, etc.: (which is another difficult job)
Apply economies of scale & invest (*) in a **series of ships** of the same design (sister ships)	Increase the ability to move fast when the markets are changing fast	Achieve a low cost capital; i.e. a lending rate, ask for variable debt installments; have a reasonable debt; have a clever & variable depreciation	Achieve a world-class financial management skills; i.e. apply properly the principles of "financial engineering"

Source: author; some data comes from Lorange (2009); (*) this strategy applied by the Greek shipping company "Eletson", (in product carriers), however, it does not concern economies of scale per se, we believe, but it has certain advantages.

The 1st box of Table 4 tells us what managing a shipping company is all about, meaning to understand how demand and supply of ship space determine the freight rate, what role a voyage distance plays in shaping demand, and the importance of the seaborne trade determining the volumes of goods that have to be transported by ships.

Between 1982 and 1985, e.g., ~94 m dwt of tankers (UNCTAD), have been scrapped and their demand also fell. This is not a frequent situation when supply *and* demand have both been seriously reduced. But even if demand for ship spaces increases, *does not mean* that the freight rate will also increase (Graph 5).



Source: author.

Graph 5. A simulation of the short run Supply facing a fast changing demand (an 11-month time horizon).

As shown, the D_1 demand for ship space, starting from a low level, increased let us say 50%, from D_1 to D_2 and 15%, from D_2 to D_3. Supply had no enough time (short run) to increase even faster than demand, but its existing initial level was more than adequate to satisfy the existing demand. As a result, the freight rate increased only from \$8000 to \$9000 (12.5%).

As the demand further increased, from D_2 to D_3, the freight rate increased from \$9000 to \$2,4300 (2.7 times)... This simulation has described the situation when even a *small* rise in demand (15%), when facing an inelastic supply, can produce a *very large* rise in freight rates (2.7 times).

Graph 5 indicated further how important is the elasticity of Supply for the level of the freight rate, given demand—most of the times neglected, as the emphasis is given on the elasticity of demand, if at all. Most of the first part of the Supply is almost *absolutely elastic* up to the intersection with D_2. After this point, supply takes an almost absolutely inelastic shape, where small increases in demand bring-in large increases in freight rates, as the orders placed in the shipyards cannot yet reach the market due to the (11 months) construction lag.

It is now when the laid-up ships have to leave their anchorage, minimizing their port time and the off-hire one and use their economic speed so that their supply to rise by all known means to satisfy the rising demand—i.e. before ordering ships and delivering them.

The reader may calculate[6] the elasticity of Supply in its first elastic part, and he/she surely will find it > 1; and for the second inelastic part this will be found < 1.

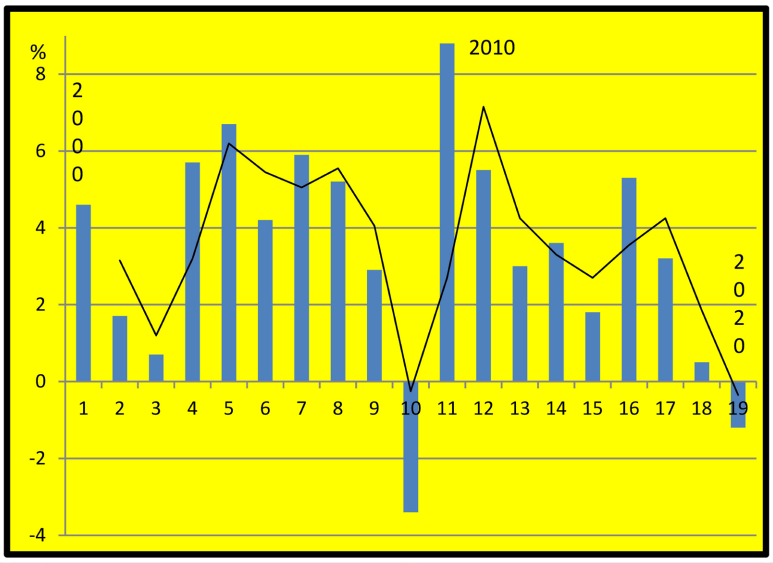
6.1. The Role Played by the Distances in Shaping the Demand for Tonnage

Important ingredient of Demand—often ignored as well—is distances (Graph 6), which ships have to cover from their starting port to that of the final one, due to geopolitical factors, and also due to closures/interruptions of the two important Canals of Suez and Panama.

As shown, the demand for ship space strengthened in 2010, by an almost 9% increase in average distances, and this, for the dry bulk carriers, meant a rise from 5200 nm in 2000 to 5500 nm (6%) in 2024. Distances increase also when distant sources of supply of a lower price or of a better quality emerge (sea exports) or distant sources of demand emerge (sea imports). We saw this to happen with the iron-ore exported by Brazil originally versus that exported by Australia latter to Japan.

Oil distances also have been modified since the time of the North Sea oil discovery, and when certain oil refineries left Middle East. Moreover, big importers, like China, have also emerged for iron ore, grain, coal and oil, thousand miles away from supply centers.

[6]The coefficient of the freight rate elasticity of Supply is defined as the % change in the dwt quantity *supplied* divided by the % change in the *freight rate*.



Source: author; data from UNCTAD 2024.

Graph 6. Changes in distance in nautical miles, 2000-2020.

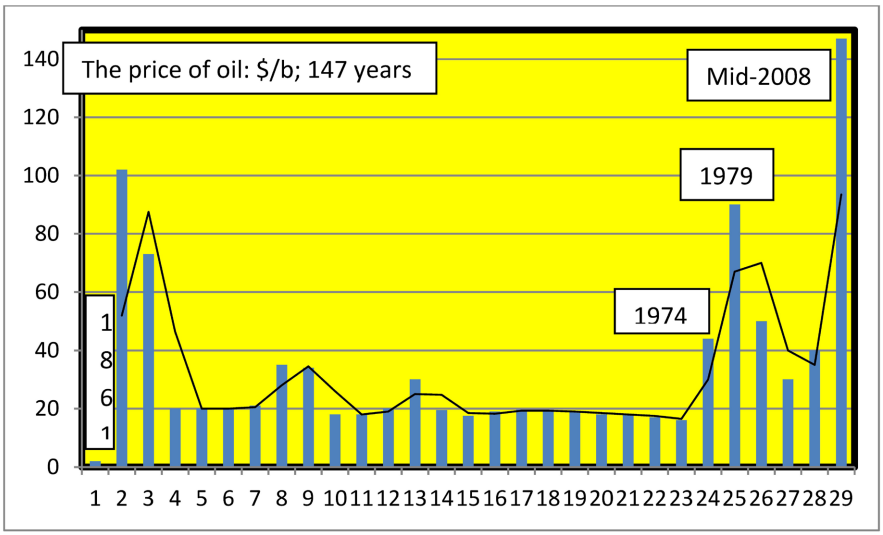
Concluding this part, we saw in the 2nd box of **Table 4**, the timing to be mentioned again, given its importance, but this time its difficulty is recognized. In the 3rd box, the shipping cycle is mentioned, and the author suggested the recent analysis done by Goulielmos (2026). The 4th box reminded us—in a wishful thinking—about the need to *forecast* the future freight rate markets of bulk carriers and of crude oil markets, the LIBOR interest rate, the price of oil, the sea distances, etc. The difficulty of these endeavors, however, has to be admitted.

6.2. The Role of the Price of Oil

Moreover, the price of oil is important because it influences the consumption of oil and the demand of oil then falls as the price of oil rises (the law of demand). As shown in **Figure 3**, the price of oil, from 1879 to 1973 (94 years) *was rather low, i.e. below $35 a barrel*. And so were and the freight rates of the crude oil tankers (not shown). This means that the price of oil determines the demand for oil, and the demand for oil determines the demand for tanker space given the distances and the geopolitical events. *Forecasting thus the oil prices is a good indicator for the future demand for tanker spaces*.

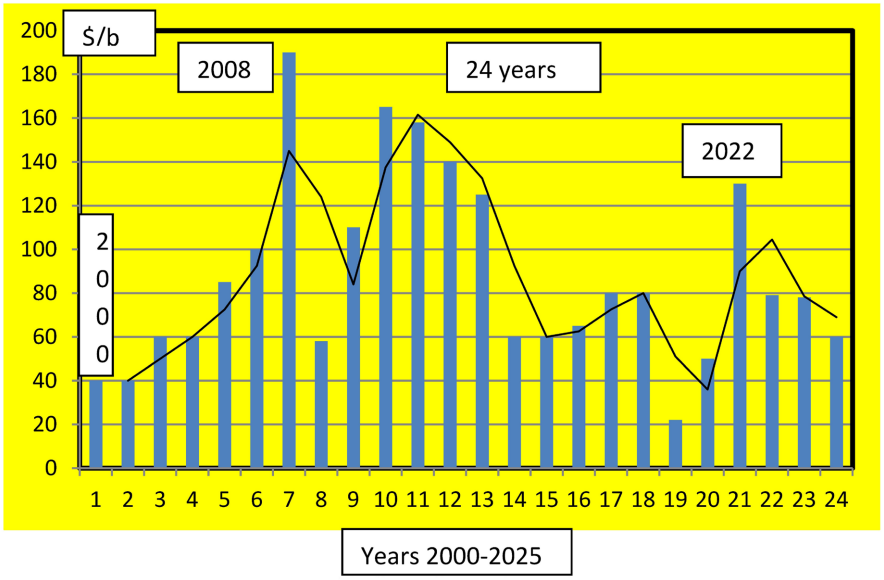
As shown, the price of oil jumped-up in 1974, in 1979 and in 2008, from $44/b to $147... We had thus *three oil crises during this period... and six thereafter*.

As shown in **Figure 4**, the recent cycle of the price of oil—deflated—showed substantial changes, i.e. from a low of $22/b in 2020 to two all times high, in 2008, of $190, and of $130 in 2022. The law of demand, as a result, reduced the demand for oil in 2008, 2010-14 and 2022, and subsequently the demand for tanker space reduced (not shown). The new war between Iran and Israel-USA will certainly cause the rise of the price of oil depending also on the closure of the Hormuz straits, where 25% of the world oil departs.



Source: author; data from Lorange (2009: p. 17).

Figure 3. The $ price of oil per barrel (2006 exchange rate), 1861-2008.



Source: author; data from "Kathimerini": a Greek weekly Journal; inflation increased the price of oil by about $34/b in 2008 or 23%.

Figure 4. The $ price of oil (deflated) per barrel, 2000 (Jan.) - 2025 (July).

The importance of oil, in world's economic life, no one can ever deny. Moreover, certain illegitimate hopes created from the taken-over of the "management" of Venezuela's oil—if its quality/quantity is proper—by USA. Is this action going to drop the oil prices below $60/b (as it was in July 2025)? Venezuela is on top among the 10 worldwide countries having the higher amount of confirmed oil reserves, i.e. 303 bb in 2023 or 17.5% out of the 1.729 bb world total, including 244 bb from other countries.

The vested interests in oil are huge and thus oil producing countries will do

anything they can to maintain the hegemony of oil, where Russia and USA cannot help, decisively, to the contrary, as they had the lowest confirmed oil reserves, before Libya, i.e. 80 and 55 bb respectively (4.63% & 3.18% of the world total in 2023).

We may, however, remind the reader that in the strategic products he/she has to add, very soon, if not already, water, given that 6.6 b cubic meters, which are needed by the uprising use of the world > 26,000 data centers by 2027 (>1/2 of the water used by UK in 2023).

"Managing the Water" will be the next prominent science, equivalent to that of managing the world energy, we believe. But humans for the time being are in deep sleep. The nation, which will be on the hegemony of all others in future, will be the one producing energy as the Sun does, and having the greatest reserves of water...

Türkiye e.g., will try to "manage" the waters of the two famous rivers running near its borders ("Tigris" & "Euphrates") in a rather exclusive way. North Greece depends much on the waters of "Evros" River, a 530 km long river—run in Greece (by 74%), Türkiye (26%) and Bulgaria (?).

The 5th box of **Table 4**, reminded us about seeking, in shipping, economies of scale, by implementing the idea of building sister ships. Economies of scale are a good thing, we believe, *if the proper demand for them is there*, and the charterer is reliable. Shipbuilding, we believe, has no problem to build ever larger ships.

The risk rests with the shipowner and is better to build larger ships within a chartering cooperation with a first class charterer. Greeks used to do that when they were building their super tankers in agreement with the 7 oil companies. Building sister ships this has certain obvious advantages, but the company does not exploit economies of scale per se by building sister ships (Lorange, 2009, argued differently).

The 6th box recommends taking decisions fast, when markets are changing; but we recommend taking decisions as fast as the facts are progressing in the real business life, because all decisions cannot, or should not, be fast. Perhaps the 6th box means to monitor the changing circumstances in the worldwide shipping and react in time.

To exploit opportunities worldwide is a philosophy of the Greek shipowners, especially in obtaining cheap 2nd hand tonnage. However, Greeks did not run fast after the latest ship technology by waiting to see its results in the hands of their competitors. Greeks prefer to obtain ships in their 5 - 10 years of age so that to reap their competitive advantages at a lower price vis-à-vis the first owner.

The low cost of capital, however, is an imperative issue (box 7th); we recommended, however, something different and cleverer in a bank loan, i.e. to agree variable installments analogous to company's gross profit, with a possibility to prolong or shrink debt's tenor in future. **We believe this to be accepted by the banks.**

The same philosophy, as the above, we recommend to shipowners to apply it to company's depreciation, i.e. it to be analogous to company's gross profits p.a. The

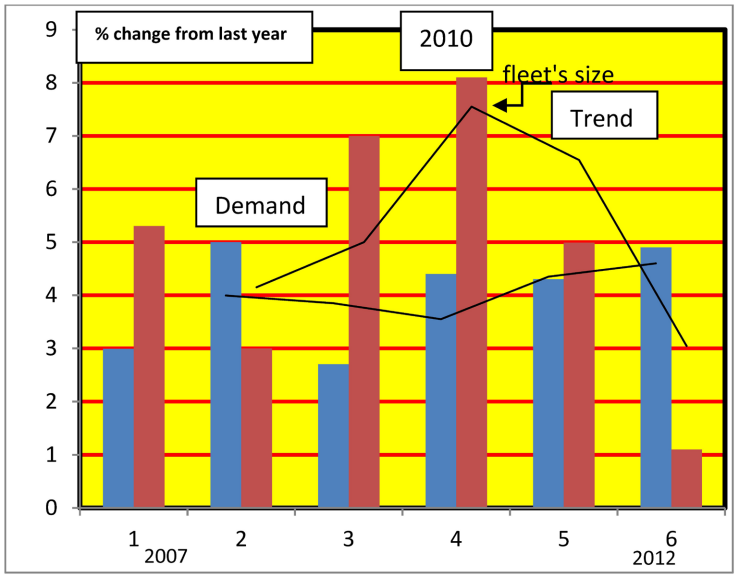
above two measures, we believe, will provide a fairer treatment of the shipping companies by the banks, which are subject to business cycles. The low cost of capital obviously is related to our recommendation in 8th box. "Financial engineering" is there to achieve exactly that: "a low capital cost".

Let us present now the business style of the shipowners, who build ships, *because* other shipowners also built ones, despite ... their falling demand...

7. Part V: What Does It Mean "Not to Be Left Behind" in Shipping Industry, 2005-2012?

There is a "time lag" between an increase in demand, which is expected to trigger new orders of ships, and the delivery of them—11 months later. Thus demand at t_0 should be compared with the supply at $t+_{11\ months}$, so that to take into account the building lag, here assumed equal to a maximum of 11 months on average (with the exception perhaps of such more sophisticated ships like ULCCs & large LNGs/LPGs).

Figure 5, shows the balance between Supply and Demand of "crude oil tankers", between 2007 and 2012. It also shows that their supply *moved faster,* in 2007-2011, than demand. This means that shipowners ignored the falling demand in their orders. In 2012, e.g., supply grew at a rate five times slower than that of demand...

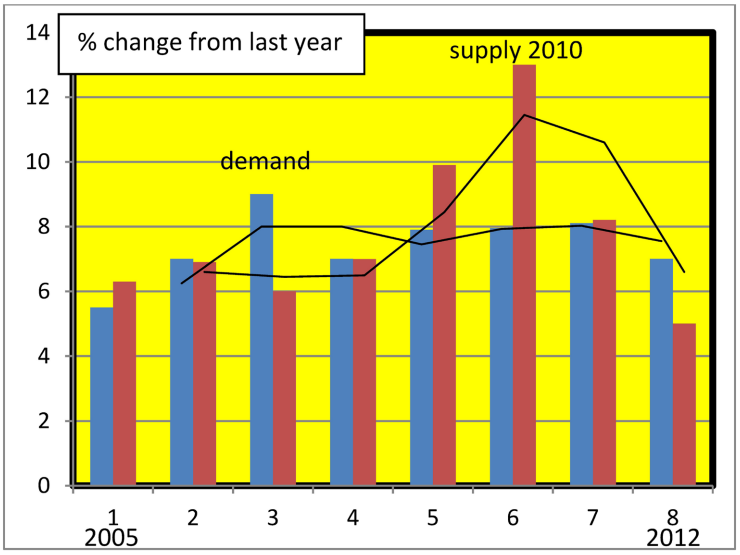


Source: author; data from Lorange (2009).

Figure 5. The balance between the changes (from y to y) of the crude tanker fleet (supply) and demand, 2007-2012.

The tanker owners, apparently, ignored demand's *stagnation* in 2010-11, and its fall in 2013 (not shown). *They felt a fear to be left behind*, at a time when almost *all shipowners* ordered tankers... In addition, in 2009 and in 2010 the demand for tankers also fell...

The dry cargo owners behaved also similarly as the tanker ones (Figure 6).



Source: author; data from Lorange (2009).

Figure 6. Dry Bulk carriers' demand and supply in dwt, 2005-2012.

As shown, the demand for dry cargo ships was stagnant 3 whole years, i.e. from 2009 to 2011, and also fell in 2012. The owners were very liquid as a result of the 2003-2008 boom, but they showed an unjustified high optimism because of the unfavorable demand indicators in 2008-2010... Also, shipowners failed to follow demand in 2009 and 2010. One may add here that the investment activity of the shipowners is different if they get-out from a boom or if they get out from a depression. We will turn now to our conceptual subjects.

8. Part VI: Financial Engineering

In **Table 2**, and in box 2, and in **Table 3**, and in box 2, and in **Table 4** and in box 7, we suggested to shipowners to finance their ships by achieving an "acceptable" capital cost, meaning the *lowest possible cost* of capital. This is not an easy task, which belongs to "financial engineering"—a new discipline.

The "cost of capital" arises from the capital borrowed mainly from the banks, the stock exchanges, the bond markets and... from company's shareholders. The company pays a «rent» to the above owners of capital, in the form of interest, or dividend, to convince them to part from these funds, by paying also to them a risk % for losing them.

The above endeavor is clearly a core subject of a new multidisciplinary field called "Financial Engineering"—FE thereafter. FE appeared, we presume, in a book form in 1992 (Marshall & Bansal, 1992), and it can be defined as the "science, which applies technical methods—derived par excellence from Mathematical & Computational Finance—to the practice of finance (Beder & Marshall, 2011).

FE, we believe, is a multi-selective, "mosaic", discipline, because it has drawn especially from at least four disciplines: applied mathematics, computer science, statistics and economics.

Mandelbrot and Hudson (2006), as well a number of others[7], demonstrated the shortcomings of the modern conventional finance... Of course FE is misnamed, and as a result is classified as a branch of Engineering, though it is not. In fact, FE is a branch of "Applied Finance". The need of professionals to understand, and profit from the management of other people's savings, including new financial products etc. sold by the banks, and the finance needs of the enterprises, led to the development of this new profession.

FE's main 10 applications are shown in Table 5.

Table 5. The 10 main applications of the FE.

Arbitrage	Corporate Finance	Derivatives' pricing	
Financial regulations	Portfolio management	Risk management	Structured bank products
International finance	Financial administration	Valuation of Options	Source: author

We will describe only the first 3. "Arbitrage" is an old operation, where an asset, (good or currency), is sold, and purchased, at the same time, in two (or more) markets. These markets should have a price difference so that to provide a profit to arbitrageur.

"Corporate finance" concerns the single large corporations with a separation of ownership from control where their needs of finance are substantial. A "derivative" is a "financial contract" with a value based on some underlying asset (like the price of a stock, bond, or good). Shipping we believe may fall in the case of corporate finance. Lorange (2009) argued that a shipping company has to have five cultures, so that to be successful, one of which is "Financial Engineering".

9. Part VII: Financial Analysis of a Company

Table 6 mentions the main issues of FA, which managers need to know.

Table 6. The main 5 issues which Managers have to know in the area of company's FA.

Leverage	Income statement	Risk	Cash Flow
Forecasting			

Source: author; data from Priesmeyer (1992, Chapter 5).

An area of improvements in FA, for the sake of the enterprises, is to make more *meaningful* the variables involved in company's "income statement", the "balance sheet" and the "cash flow". E.g. the positive "net profit before tax" provides only the information that the net profit is positive. "A net profit margin divided by total sales" is more telling, showing *how much of company's sales* finally have emerged as *net profit*.

[7]Ten books from 1975 to 2004; a total of 55 publications till 2006.

Another issue is to divide "net profit" by "total assets" to get the ROA (the return on assets/vessels)—which is a measure of profitability. Another improvement is to allow time to accompany the above statements, like e.g. by asking: "was company's profitability ratio going-up, while debt ratio went also up?" "Does the improvement in the "gross profit margin" mean also improved "net profit margin"?

Managers must focus on the ways company's activities resulted at the figures reported, and not on the figures per se. Sales e.g. are driven by the nature of the relation between products, or services, which a company sells, and how company's staff attempts to sell them, and the characteristics of the market every time. Sales are an accumulated sum of dynamic activities, which occurred over the past.

In shipping, the $ sales to be achieved by ships are pre-calculated per voyage, and also the expected net profit/loss is calculated before hand, i.e. before the shipowner decides to accept the job. There is also the possibility for the pre-calculated net profit to be compared with the actual one, after a voyage is completed. Thus the *risk* in shipping can be greatly reduced, because the shipowner is free to undertake, or not, a voyage, which is forecast to leave a $ loss.

Apparently manager's decision is based on the *accuracy of the calculations made-out by the staff of company's in-house chartering department...* Also, the expenses per day of the ship are derived from the annual computerized budget of the company per vessel, where mistakes could also be committed...

Management thus, in shipping, has to use the latest "digital technology" (concerning e.g. ship's actual speed in the particular voyage; the actual sea distance of the particular voyage; taking the actual weather conditions into account, the port congestion-strikes-holidays, snow, rain and port's working hours; to know the latest Canal dues and their crossing time; etc.), in calculating the daily expenses of company's ships per vessel as accurate as possible, and the latest developments in "zero budgeting" theory in "the forecasting of vessel's voyage result".

The comparison between actual and forecast voyage result has to be examined without any exception by company's Economic department for every voyage, and all deviations to be explained by a report to management. Then, measures/additional training, to be decided so that more accurate future calculations to be produced by the chartering brokers, as this is so apparently crucial for company's existence... and on which management rests.

Also a ratio may be established taking the "forecast voyage result" and divide it by the "actual voyage result" for every voyage. Number 100 will indicate that the two figures are equal, and the forecast proved to be also equal to actual. While ratios above 100 are welcome, ratios below 100 had to be investigated, and especially those below zero and to be explained to management.

Moreover, "profits" reflect the combined effort of the selling/chartering activity, and the cost of the operation activities, in the firm and in the vessels. The "net profit margin" is an expression of that dynamic relationship, which changes continuously, and traces some evolving patterns.

Activities that are behind the numbers must be analyzed and focused on their interactions, if management wishes to control company's future. We have to find-

out the prospective of the past patterns. FA has to report any changes between company's courses, which has been travelled so far, against those that *the management would have preferred*...

Let us present in more detail company's Income Statement.

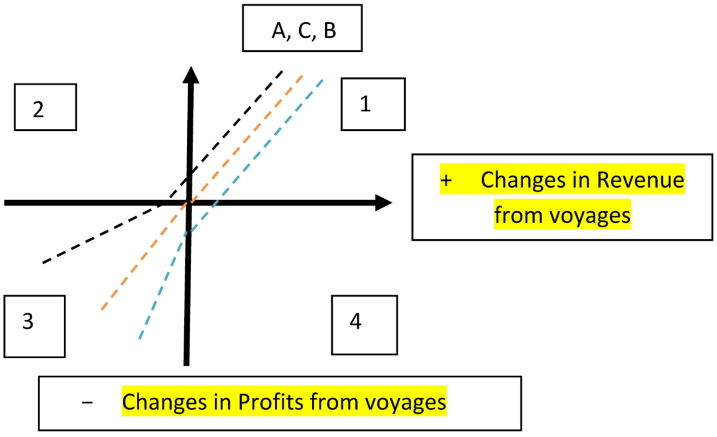
10. Part VIII: The Income Statement of a Firm

We can use a "phase plane" to deal with a company's "profitability measure". During our research, and at its beginning, we worked mainly with Time Series. These, however, failed to illustrate the "complex and cyclical patterns" that exist in the enterprises. Then, Goulielmos and Psifia (2006) suggested to use a new method especially in dealing with Shipping Finance.

A "plane" was needed to refer to the domain in which a system operates, to an arena for a system's performance and for a home for system's attractor. This was the "phase" plane. This means to use a Cartesian, (i.e. due to Descartes R, 1596-1650), plane, and have its horizontal axis for the independent variable, denoted by X, and its vertical axis for the dependent variable, denoted by Y.

There were made two innovations to the above idea: (1) one made by Smale (1967), i.e. to map *the changes of the variables* shown on the X and Y axe, instead of showing only their absolute amounts, and only in quadrant 1, as hitherto, and (2) to use also the 2nd, the 3rd and the 4th quadrants. Smale by so doing opened the door to the nonlinear analysis. Priesmeyer (1992) defined further the methods of the "Nonlinear Management".

Let **Figure 7** being a "phase plane" diagram of the income statement after making it suitable for a shipping company.



Source: author.

Figure 7. The phase plane of income statement of a Shipping Company.

If a company is found on the course denoted by letter A, this means that it was able to *avoid a proportional decline* in its "net profit" from vessels, while its "revenue from voyages" fell. This company is *adaptive*. If the company is found in the course denoted by letter B, it means that it has suffered a disproportional loss,

when revenue from voyages was also lower. One explanation is that this company had probably a high *fixed cost*, and it was not able to reduce it. This company is *rigid*. This company, moreover, cannot respond to changes in demand. In the course denoted by letter C, company's "net profit margin" was constant.

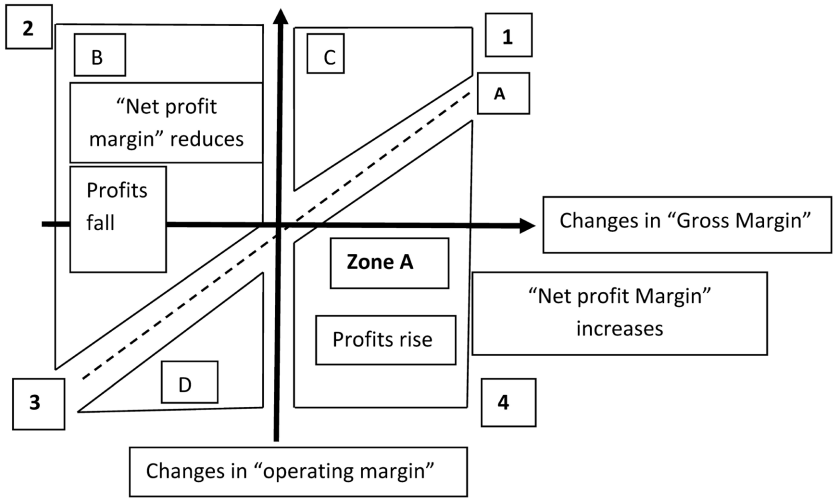
Table 7 shows now what it means for a company to be in Quadrants 1 - 4.

Table 7. The meaning for a company to be in quadrants 1 - 4.

At Q_1, the "net profit" increased	At Q_2, the "net profit" increased	At Q_3, the "net profit" reduced	At Q_4, the "net profit" decreased
At Q_1 the voyage revenue increased	At Q_4 the voyage revenue increased	At Q_2 the voyage revenue declined	At Q_3 the voyage revenue declined
At Q_2 an improvement in profit occurs, while voyage revenue is worse—common though remote	At Q_2: a good but not sustainable position, with increasing profit, with a fall in voyage revenue	At Q_4 voyage revenue is better, while profits fell—something bad; better for the company to go to Q_2 for a good correction	Source: author; data from Priesmeyer (1992: p. 105).

A movement between 1 and 3 quadrants is something to be expected: there, the voyage revenue increased, or declined, along with the existing market demand, where some effect on "net profits" has to be expected. But the company had to *reduce expenses*, when voyage revenue is reduced (line A).

Let us now draw the "Net Profit Margin"—NPM phase plane (**Figure 8**)—together with that of "total profit"—as the two may differ. In A, total profits increase, unlike NPM.



Source: author; data from Priesmeyer (1992: p. 110).

Figure 8. The Phase plane of the "Net Profit Margin".

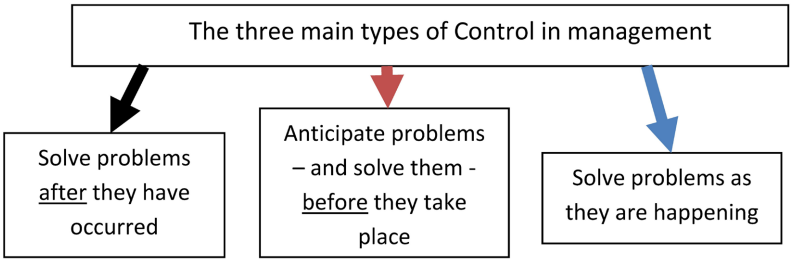
The "operating margin" rises so that to erode the increases in GM%. In B, total

profits—TP will decline as the OM does not decrease sufficiently to offset the fall in GM. In C, both GM and OM rise. NPM will fall, when TP will rise, if there is a sufficient rise in voyage results. In C, TP decline, if the increase in GP is not sufficient to cover the rise in operating costs. In D, TP may be higher or lower. In zone A, profits increase, and this is the *desired position* for a company to be (i.e. between 1 and 4 quadrants).

11. Part IX: The Effect That AI, Robots, Nano-Satellites, etc. May Have on Shipping Management

Nowadays[8] shipping managers co-manage their ships with their Captains, because their ships operate thousands of nautical miles away from company's shore office (headquarters), as mentioned. The times when the shipowner travelled on board, in "Owner's cabin", have passed without return.

In shipping industry from the 4 management functions (leading, planning, organizing & controlling) the most important, we believe, for shipping, is Control (Graph 7).



Source: author; inspired by Robbins & Coulter (2018: p. 643).

Graph 7. The three main types of Control in management.

The best control is to "anticipate the problems" and to "prevent them". This means, however, *a long experience* and a *high imagination*, which most shipping managers, operators, departmental managers and Captains lack. The first l.h.s. control is the common one, but it is also the most expensive, which may be also catastrophic... This is based on the "negative" feedback (Battram, 1998: pp. 157-168).

The last r.h.s. type of control *is not available* to shipping managers—though most desirable—due to "management by distance". It is also known as "feedforward control", "direct supervision" & "management by walking around", a type of management that can be applied, however, by Captains, if trained for it.

All managers need appropriate tools for monitoring and measuring their factories' performance, and shipowners are not an exception to this rule. But for ship-

[8]A manager had to manage many ships. The "blind" initial management period when the communications between managers and his/her ships were impossible or extremely long, gave its place to rather immediate satellite communications. The use of mobile phones and faxes also improved control in a rather more effective way than correspondence, cables & telexes.

owners there is one problem: distance. Here apropos emerged a "telemetric" system called LAROS, in 2010, by a start-up Greek company, destined to provide (by 2011) reliable data from the vessels by building and using a "nano-satellite"[9] weighted 5 kg... Thus, the measurement from moment to moment of ship's bunkers; the malfunction of a ship's generator or of a pump, are since 2011 feasible and most useful to ship's technical management at shore.

Of course there are a great number of cases where digitalization can help in optimizing ship's operations, as e.g. (1) "what is the efficient stowage of a cargo?" or (2) "what is the most economical route to take?" Or (3) "what the weather conditions will be in next 7 days along ship's route?" The technology of robots e.g. can be used in reducing marine accidents. Having e.g. robots, instead of seamen, to enter into dangerous closed spaces on board, where an explosion and death are expecting...

Moreover, Keynes' fear, derived from his observation that in "capitalist economies" investment opportunities will be rarer, as their growth continues, let us say, as he did, within the horizon of one generation (Keynes, 1936: p. 220), is going not to be verified—given the amounts that are going to be spent on AI in 2026 and thereafter by at least 14 international giant companies...

The 7 prime world companies[10] of AI spent in 2025 more than $400billion... and it is expected that they will double this amount by 2026. Moreover, one of them can be also more economical in AI than the rest of the countries dealing with AI, and building also more data centers, as the case of the Chinese "DeepSeek".

Keynes (1936: p. 220) can continue to rest in peace and to "admit" that there is no need for us to look forward for his millionaires to build mighty mansions and pyramids, so that the country's investment to become equal to its saving...

And when AI will complete all its investment, the production of energy as Sun does it, will be next, and the proper management of water will be even further next, we expect. Humans have this rare ability to[11] find-out ways for spending", provided the humanity will have escaped from the hegemony of the computer at

Nations nowadays should deal with emphasis with computers, AI, pharmaceuticals, missiles (given the wars), aircrafts, automobiles, ships, software, telecommunications equipment, rare earths, energy production the way of the Sun, water management, fiber optics and in general with those parts of the market that are "knowledge-based" (Battram, 1998: p. 161) showing the so called "increasing returns" (Brian Arthur, 1990).

12. Conclusion

A "perfect-timer" shipowner is the King, and he/she will also become a Leader

[9]This is called a "Marine identification and communications system"—MICE.

[10]The "Seven Magnificents" are: Alphabet, Amazon, Apple, Microsoft, Meta, Nvidia & Tesla; also, Moonshot AI, OpenAI, Anthropic, Google, Alibaba, Baidu & Tencent.

[11]A new type of steel invented. In fact, in shipbuilding we need a new cheaper and stronger material than steel. Ships nowadays are very expensive requiring an amount approaching the $150 – 190 m per vessel... This requires high freight rates for them to be efficient.

among all other shipping managers. The clever shipowner builds ships, and buys them, at *rock-bottom prices,* when freight rates are also at their rock-bottom levels *and ready to rise* (given the time lag between a rise in demand, a fall in supply & a quick rise in freight rates).

One, in his/her analysis, has to underline the importance that perfect timing (Goulielmos, 2021b) has in doing business in Shipping—given that the new building prices, the 2nd hand ones, the time charter rates, the spot ones, the scrapping prices, the LIBOR, are all time-dependent.

In 2025, the intense geopolitical influences on shipping industry coupled with IMO's inability to support[12] the use of an alternative "New Zero Fuel" caused a reduction in orders for newbuildings and a widely-spread uncertainty. The 2025 world orders for ships *fell* to 2531 ships of 122.5 m dwt (48,400 dwt average size) from 3832 ships and 187.2m dwt in 2024 (average size 48,852 dwt).

The fall in orders also caused the *disappearance* of the economies of scale... The 2025 figure was ~65% of that in 2024 in number of ships (in dwt). This means that shipowners decided to pursue economies of scale provided that they grew. The above decision will lead the industry to lower profit in 2025 and thereafter.

In addition, it is better to pay a fixed % of dividends, equal, or slightly, higher, than the interest rate of a 12 months bank deposit, every year, plus a risk %. Shareholders are entitled to improve their standard of living reasonably, out of their equity in the company, but their big money has to come from a shipping boom or by a successful game with company's assets...

Shipowners are recommended to grow, from y to y, when demand moves faster than supply, so as to have an increasing level of freight rates. Clever shipping companies had to multiply their earning assets by taking *perfectly timed* decisions, but why have they failed recently to do that? As **Figure 5** and **Figure 6** showed, this has not been achieved between 2005 and 2012, when both the owners of the world crude oil Tankers and of Bulk carriers ordered ships along with a falling demand...

One explanation of the above is that shipowners were led by the "fear not to be left behind", when everyone else in the industry used to build ships... This is when a wrong psychology comes-in. *This was a wrong strategy. This confirms the idea that enterprises do not always act rationally. As Mandelbrot and Hudson (2006: p. 84) argued people are not always rational.*

In shipping, a shareholder expects from company's manager to minimize costs, while he/she is sympathetic when the manager fails to maximize company's net profit... Managers after all: (1) should have the ability to manage "cleverly" company's "financial flows" and "budgets"; (2) to deal with "currency issues"; (3) to deal with "interest rates" and (4) to deal with, the increasingly used, new instruments and "derivatives" related to the "futures freight market trading". Greeks are very conservative in dealing with this last one (Goulielmos & Goulielmos, 2008).

[12]The IMO's decision on "net-zero framework" (NZF) postponed for 2026. Shipping industry consumes 350 m tons of fuel p.a.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

Arthur, W. B. (1990). Positive Feedbacks in the Economy. *Scientific American, 262,* 92-99. https://doi.org/10.1038/scientificamerican0290-92

Battram, A. (1998). *Navigating Complexity: The Essential Guide to Complexity Theory in Business and Management*. The Industrial Society.

Beder, T. S., & Marshall, C. M. (2011). *Financial Engineering: The Evolution of a Profession*. J Wiley & Sons. https://doi.org/10.1002/9781118266854

Bookstaber, R. (2007). *A Demon of Our Own Design: Markets, Hedge Funds, and the Perils of Financial Innovation*. Wiley.

Goulielmos, A. M. (2021a). To Be or Not to Be Listed? A Dilemma of the Greek-Owned Cyclical Shipping Companies, 1993-2018. *Modern Economy, 12,* 401-428. https://doi.org/10.4236/me.2021.122021

Goulielmos, A. M. (2021b). Why the Perfect Timing Achieved by the Managers of Shipping Companies Is So Important? *Modern Economy, 12,* 597-622. https://doi.org/10.4236/me.2021.123031

Goulielmos, A. M. (2026). A Successful Shipowner Has to Learn How to Face the Shipping Cycles. *Modern Economy, 17,* 383-405. https://doi.org/10.4236/me.2026.173021

Goulielmos, A. M., & Goulielmos, M. A. (2008). Do Nonlinear Tools Make a Difference in Handling Shipping Derivatives? *International Journal of Transport Economics, 35,* 345-371.

Goulielmos, A. M., & Psifia, M. (2006). Shipping Finance: Time to Follow a New Track? *Maritime Policy & Management, 33,* 301-320. https://doi.org/10.1080/03088830600783301

Keynes, J. M. (1936). *The General Theory of Employment Interest and Money*. Macmillan & Co Ltd.

Lorange, P. (2009). *Shipping Strategy: Innovating for Success*. Cambridge University Press.

Lorange, P., & Norman, V. D. (1973). *Shipping Management*. Institute of Shipping Research.

Mandelbrot, B., & Hudson, R. L. (2006). *The (Mis)behavior of Markets: A Fractal View of Financial Turbulence with a Preface on the Financial 2008 Crisis*. Basic Books.

Marshall, J. F., & Bansal, V. K. (1992). *Financial Engineering: A Complete Guide to Financial Innovation*. New York Institute of Finance.

Priesmeyer, R. H. (1992). *Organizations and Chaos: Defining the Methods of Non-Linear Management*. Q Quorum Books.

Robbins, S. P., & Coulter, M. (2018). *Management, Global Edition* (14th ed.). Pearson.

Smale, S. (1967). Differentiable Dynamical Systems. *Bulletin of the American Mathematical Society, 73,* 747-817. https://doi.org/10.1090/s0002-9904-1967-11798-1